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# NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
1520 H STREET, NORTHWEST · WASHINGTON 25, D. C.
TELEPHONES: DUDLEY 2-6325 · EXECUTIVE 3-3260

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July 13, 1961

NOTE TO EDITORS:

Attached is the press kit for the second manned Mercury suborbital launch, Mercury-Redstone 4, or "Liberty Bell." The material in the kit is for release Sunday, July 16, 1961.

The kit contains four sections:

1. MR-4 Design Changes
2. Mission Profile
3. Launch Chronology
4. Recovery Forces

An additional set of background pieces is available at the NASA News Center in the Starlite Motel, Cocoa Beach, Florida, and at NASA OPI in Washington. They are:

1. The Ground Crew
2. Astronaut Training Program Summary
3. Inside the Pilot's Cabin
4. "IF" - A Study of Contingency Planning for Mercury Mission
5. The Launch Vehicle

Telephone numbers at the NASA News Center at Cocoa Beach are: SUnset 3-7626, -7, -8, and -9 and SUnset 3-7620.

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## MR-4 DESIGN CHANGES

The United States will attempt a second manned space flight in the next few days.

NASA scientists are fully aware of the high-risk factor involved in such experimental test flights. They do not believe that the Mercury-Redstone 4 flight results will differ greatly from those of Project Mercury's first manned journey into space on May 5, 1961.

Then why bother with a second manned suborbital flight? Didn't Astronaut Shepard and a carefully curried spacecraft called Freedom 7 prove out the Mercury-Redstone system?

Freedom 7 did that and more. Most importantly, Shepard proved that man could not only exist in space but perform useful tasks there as well. An item-by-item listing of all the things Mercury-Redstone 3 proved would fill a small library.

That hard-won data, however, must stand the test of time and later flights. Each item becomes a dot on a scientific-engineering knowledge curve. Each flight adds significantly, if not historically, to man's understanding of the strange environment of space.

The MR-4 spacecraft, nicknamed Liberty Bell, will be quite similar to the Freedom 7 craft. It too will weigh about two tons at liftoff; measure six feet across its blunt bottom and stand nine feet high. It too will be fitted out with a 16-foot escape tower; its titanium pressure cabin housed in a "shingled" skin of a temperature-resistant alloy.

Most of the major systems will be the same - environmental control, escape, communications, heat shield, landing apparatus.

But there also will be significant changes in "Liberty Bell." These changes appear in the spacecraft not because of any failing of the Freedom 7 craft but as dramatic evidence of the concurrency concept used throughout Project Mercury.

This concept finds research, development, design, engineering, manufacturing and flight test proceeding simultaneously in an effort to achieve the project's goals in the shortest possible time span. Improvements are introduced in the production line at the earliest feasible time but at a point which will not delay the flow of production vehicles.

Most of the design changes in "Liberty Bell" were put into production more than a year ago - many of them suggested by the Mercury astronauts shortly after they joined the Mercury team more than two years ago.

A year ago Freedom 7 was in the advanced production stage while Liberty Bell had not yet started down the production line of McDonnell Aircraft Corp., NASA's prime contractor for Mercury spacecraft. Thus it was possible to make the following changes in the Liberty Bell craft, a copy of which is destined to carry the first American into orbit:

WINDOW -- An enlarged "pilot observation window" replaces two six-inch circular ports used in Freedom 7. The trapezoid-shaped window measures 19 inches high, 11 inches across the base and 7½ inches across the top. It is located directly above the pilot.

The window will be used as a navigational aid, just as the spacecraft's periscope and infrared sensing equipment are used. It will permit a direct view of the horizon, thereby allowing the astronaut to determine the spacecraft's attitude. With reference lines inscribed on the four-pane window, the pilot should be able to hold the capsule precisely at the required

34-degree attitude for firing of retrograde (braking) rockets at the peak of his flight.

Obviously the window should provide a better view of the Earth, cloud cover and perhaps stars. At peak trajectory, the pilot's Earth view, depending on cloud cover, may take in various Caribbean islands and much of the United States' East Coast.

PILOT TASKS -- If all goes well, the MR-4 pilot won't have to work as hard or as fast as did Alan B. Shepard, Jr. While the MR-4 pilot is programmed to perform many of the same spacecraft control functions, he should have more time to look around inside and outside the capsule.

During Shepard's five minutes of weightless flight, he carried out many more tasks than are usually attempted in a similar period in aircraft flight test work. For instance, Shepard used the manual control system one axis at a time: First pitch, then yaw, then roll. This was done because a pilot had never controlled a craft in space before. It was desirable to assess his capabilities in precise steps.

Since Shepard encountered no difficulties in these maneuvers, the MR-4 pilot will simply flip a switch and pull a special "T" handle on his left console, placing all three axes of spacecraft attitude at his command. But at this point, the pilot probably will call for only one or two attitude shifts.

RATE STABILIZATION AND CONTROL SYSTEM -- After retrofire, the pilot will switch to another new system of manual control being flight-tested for the first time - Rate Stabilization and Control System (RSCS).

In the straight manual system used in Shepard's flight, the hand controller served directly to open and close 6 gas jets at the base and neck of the spacecraft which turn the craft about on its axes. This type of control, while highly reliable, does not offer very precise maneuver control.

In Liberty Bell, the pilot will have the use of a similar manual control system. He can also elect to switch to RSCS. With the latter system, the pilot's hand motions are translated into electrical signals within a "black box." These electrical signals then open or close solenoid valves controlling the gas jets. The spacecraft's response will be similar to that of a modern high speed aircraft and should provide much more precise control.

The MR-4 mission astronaut will exercise the Rate Stabilization and Control System for the first time following retrofire at about 5-1/2 minutes after launch. He will stay on this control mode for the remainder of the flight.

The MR-3 capsule was made to spin slowly, at 2 revolutions per minute, during reentry. This "roll rate" will not be employed in the MR-4 flight.

HATCH -- Unlike the mechanically-operated side hatch on Freedom 7, the MR-4 spacecraft is equipped with a hatch secured by explosive bolts, just as the pilot's canopy is secured in a high performance aircraft. The astronaut can jettison the hatch by pushing a plunger button inside the spacecraft or by pulling a cable. The hatch may also be removed by recovery teams. The explosive charge has been added as an additional pilot safety device to insure easy and rapid escape in the event of an emergency. When jettisoned, the hatch may travel up to 25 feet from the spacecraft.

INSTRUMENT PANEL -- Major design changes have been made in the MR-4 panel with instrument groupings functionally rearranged at the suggestion of the astronauts for quicker and easier reference. Illustrations of the MR-3 and MR-4 instrument panels are available to illustrate changes. Notable among the changes is the addition of an enunciator (audio warning) panel on the right.

ASTRONAUT PERSONAL EQUIPMENT -- The astronaut flight suit and bioinstrumentation are the same in design and function as equipment tested during the Shepard flight, with several minor exceptions:

(1) Nylon-sealed ball bearing rings have been fitted at the glove connections of the astronaut's suit, permitting 360 degrees of wrist action when the suit is inflated. Addition of the B. F. Goodrich Company-

developed quick-removal wrist rings required no suit modifications.

(2) New voice microphones by Electro-Voice, have been included as an integral part of the pilot's plastic helmet. The new microphones are expected to insure greater reliability and higher quality performance by cancelling out the inverter noise which reduced the quality of voice transmissions on the Freedom 7 flight.

(3) Additional protective foam plastic will cushion the pilot's helmet in the astronaut's contour flight couch to reduce noise and vibration during powered flight.

SURVIVAL EQUIPMENT -- A new lightweight, radar-reflective life raft will be carried in the Liberty Bell. Made of Mylar (for air retention) and Nylon (for strength), the three-pound, four-ounce raft weighs 45 percent less than the earlier version. It features three water ballast buckets for flotation stability and a deflatable boarding end which may be reinflated by an oral inflation tube following boarding. Developed jointly by the NASA's Langley Research Center and the Space Task Group, management element for Mercury, the raft is made of the same material used in Echo satellite balloons. The raft is international orange, and the inside has been aluminized, making it radar reflective.

Other MR-4 changes include:

(1) Aerodynamic streamlining of the spacecraft-to-Redstone three-piece clamp ring fairing to reduce vibrations during transonic flight and "Max Q" (the point at which the highest airloads are imposed on the Mercury-Redstone). This design was successfully flight-tested in the March 18, 1961, Little Joe launch from Wallops Island, Virginia.

(2) A new launch angle resulting in a flight trajectory with approximately one mile higher altitude and three miles shorter range than programmed for the Shepard flight. The Freedom 7 spacecraft hit a peak altitude of 115 statute miles and landed 302 statute miles downrange. Winds and last minute program changes invariably alter slightly the final altitude and distance figures.

General purpose of the Mercury-Redstone program is to advance the qualification of the spacecraft and train astronauts for later orbital flights.

Principal objectives of the MR-4 mission are:

(1) To familiarize a pilot with a brief but complete space flight experience, including liftoff, powered flight, weightlessness (approximately 5 minutes), atmospheric reentry, landing, and

(2) To further evaluate a pilot's ability to perform as a functional unit during space flight by (a) demonstrating manual control of the craft during weightless periods, (b) using the spacecraft observation window and periscope for attitude reference and recognition of ground check points, and (c) studying man's physiological reactions during space flight.

# MR-4 Mission Profile

CAPE CANAVERAL, FLA. -- Intensive pilot rehearsals for MR-4, using actual flight hardware, have been going on for more than a month.

At the same time, the Redstone booster has been undergoing exhaustive checkout. Several weeks ago, booster and spacecraft were mated on Pad 5.

Before any launch, scores of mission simulations are run using training facilities at Project Mercury Headquarters, Langley Field, Va., and Cape Canaveral. At the Cape, a pilot can "fly" a Mercury spacecraft in a specially designed altitude-pressure chamber in the Mercury hangar.

In preparation for chamber runs to space-equivalent altitude, pilots are subjected to preflight physicals, equipped with medical sensors and assisted into their 20-pound full-pressure suits.

About two weeks before launch, three days go into simulated flight tests using the mission spacecraft at the pad. The medical transfer van carried an astronaut and aeromedical attendant from the Mercury hangar to the pad. Wearing his flight gear, a Mercury pilot went up the gantry and entered the spacecraft. A realistic countdown and simulated Mercury flight followed with ground flight controllers at their stations.

During the early simulations, the gantry remains against the vehicle and the side hatch of the spacecraft is not closed. However, a final mission "dry run" at T minus three days includes securing the side hatch, purging the pilot's cabin with oxygen and pulling away the gantry.

During the week preceding flight, the mission was rehearsed repeatedly, both in the vehicle and in a Link-type spacecraft simulator (Mercury Procedures Trainer) in the Mercury Control Center at the Cape. Three days before flight, two pilots go on a low-residue diet.

About 7 a.m. the day before launch, the flight countdown will begin. It's approximately a 12-hour count which is broken in half to avoid crew fatigue. The initial hours are largely devoted to spacecraft checks. In the booster, certain electromechanical verifications are made. Finally the "bird" is fueled and work is suspended in the early afternoon.

Here is the Mercury-Redstone rocket at a glance: Weight -- 33 tons at liftoff, including spacecraft. Height -- 58 feet; with spacecraft, 83 feet. Thrust -- 78,000 pounds. Propellants -- Fuel, 75 per cent ethyl alcohol and 25 per cent water; oxidizer, liquid oxygen (temperature of which is -297 degrees F.). Rocket development and design by NASA's Marshall Space Flight Center, Huntsville, Ala., and launched by MSFC's Launch Operations Directorate. Major Redstone contractors -- Chrysler Corp., North American Aviation, Inc. and Sperry Rand Corp.

The count resumes about midnight if the weather appears favorable. First big item in the last half of the "split" count is loxing -- loading liquid oxygen into the Redstone.

At 1 a.m., the lights will go on in the crew quarters on the second floor of the Mercury hangar. After a shower and a shave, the pilot will have breakfast. He will have a wide selection of things to eat, possibly steak, strawberries, cookies and skim milk.

Forty minutes after he is wakened, he will be given a pre-flight physical. About 35 minutes will be spent placing medical sensors against tattooed reference marks on his body. Then he climbs into his pressure suit.

T-170 minutes: The astronaut leaves the hangar in a medical van, together with a procession of escort vehicles and begins the 15-minute trip to the launching site.

The astronaut's suit will be purged with oxygen during the transfer period, and as the pilot relaxes in a reclining couch, continuous medical data will be observed at trailer consoles.

T-155 minutes: The pilot's final briefing is conducted. The medical van will have halted near the Mercury-Redstone.

Fifteen minutes are devoted then to donning his gloves and checking his pressure suit for leaks. An additional five minutes elapse as the pilot and his attendants go up the gantry.

T-120 minutes: The pilot enters the craft through the side hatch and adjusts himself in the contour couch. Communications and biomedical leads are connected. Restraint harnesses are secured about his shoulders torso, and knees. At T-99 minutes, the astronaut's helmet visor is closed and the suit is inflated to 5 pounds per square inch. Another suit leakage check is run. Then a button is depressed on the side of the pilot's helmet, exhausting suit pressure.

The suit will not be inflated during the flight unless cabin pressure fails. So the suit serves as a backup "pressure chamber" providing the proper gaseous environment to sustain life in the event cabin pressure fails.

Installation of the spacecraft's side hatch begins about T-80 minutes. The operation takes 20 minutes. A flow of cold oxygen is forced into the cabin. Leakage checks are conducted to insure that the cabin is properly sealed.

T-55 minutes: Spacecraft technicians leave and the gantry is moved away from the launch vehicle. The count proceeds.

T-4 minutes: All spacecraft systems are checked.

T-2 minutes: Onboard cameras and tape recorders are started. An astronaut serving as capsule communicator in the blockhouse announces that all further communications between the spacecraft and the ground will be by radio. Freon flow (spacecraft cabin coolant) is stopped.

T-35 seconds to lift-off - in rapid sequence: The test conductor announces "Capsule umbilical dropped." Other controller voices announce:

Periscope OK
Vent valves closed
Fuel tank pressurized
LOX tank pressurized
Vehicle Power

Boom drop
Ignition
Main stage
Lift-off

During boosted flight, the pilot will monitor carefully booster and spacecraft performance and talk with another astronaut - the capsule communicator in the Mercury Control Center.

If the mission is normal, the Redstone engine will be shut down about two and a half minutes after lift-off when the vehicle has achieved a speed of some 4900 miles per hour. It will be climbing at an angle of 40 degrees. At engine cutoff, both the escape rocket and tower jettison rocket above the capsule will be fired automatically to remove the tower.

Ten seconds after engine cutoff, a clamp ring securing booster and spacecraft will be separated. Three 350-pound-thrust solid propellant rockets at the base of the spacecraft will be fired to separate spacecraft from Redstone. By now the spacecraft is 35 miles high.

The pilot's periscope extends. At the same time, the autopilot swings the spacecraft around so the blunt end is forward and tilted upward 34 degrees instead of 14 degrees as in the Freedom 7 flight.

At peak altitude - about 115 miles - the astronaut will be controlling the attitude of the craft and will manually hold the craft at an attitude of 34 degrees. This will be the desired attitude for retrofire in orbital flights. Although retrorockets are not needed for reentry in suborbital flights, they will be fired to test their operation in space and to provide pilots with flight experience in controlling the retrofire maneuver. The astronaut then will be able to maneuver the craft for a few minutes before he establishes the reentry attitude.

During reentry, the pilot will take about 11 g's, roughly twice the g-load he gets during the powered phase of Redstone-boosted flight.

At 21,000 feet, a pressure sensitive switch deploys a drogue parachute and automatically scatters radar reflective "chaff."

At 10,000 feet, the antenna fairing at the neck of the spacecraft releases, deploying the main landing parachute. Concurrent with main chute deployment, an underwater charge is ejected to aid recovery forces, the UHF recovery beacon is turned on, remaining hydrogen peroxide - fuel for the spacecraft control system - is jettisioned.

The pilot may use the periscope or the observation window to visually check his parachute. Should the main chute fail, he can jettison it and deploy a reserve landing parachute. During descent, valves open to allow outside air into the cabin.

Upon landing, an impact switch jettisons the main parachute, releases fluorescent sea-marking dye, turns off instrumentation recorders and transmitters. The pilot, however, still has a voice radio link to Mercury recovery forces.

The spacecraft will be picked up by the Mercury Recovery Forces. These include an aircraft carrier and two destroyers in the prime landing area. Search aircraft will also be deployed in the prime landing area. Other ships will be deployed along the intended path of flight to provide for recovery in case of undershoot or overshoot.

If the flight and recovery are normal, a helicopter will lift the craft out of the water and place it on the carrier's flight deck. The pilot may elect to remain in the spacecraft until it is on board the carrier or climb out the spacecraft side hatch and be picked up by helicopter.

## LAUNCH CHRONOLOGY

CAPE CANAVERAL, FLA. - Two types of Mercury spacecraft have been used in the flight test program. First series of shots used full-scale "boilerplate" models of the capsule to check out booster-spacecraft integration and the escape system. Second phase of the development firing program used Mercury capsules built to production standards.

This is the chronology of test firings:

September 9, 1959: Big Joe. NASA-produced research and development capsule, launched on an Atlas from Cape Canaveral -- test validation of the Mercury concept. Capsule survived high heat and air loads and was successfully recovered.

October 4, 1959: Little Joe 1. Fired at NASA's Wallops Station, Virginia, to check matching of booster and spacecraft. Eight solid-propellant rockets producing 250,000 lb. of thrust drove the vehicle.

November 4, 1959: Little Joe 2. Also fired from Wallops Station, was an evaluation of the low-altitude abort conditions.

December 4, 1959: Little Joe 3. Fired at Wallops Station to check high-altitude performance of the escape system. Rhesus monkey Sam was used as test subject.

January 21, 1960: Little Joe 4. Fired at Wallops Station to evaluate the escape system under high air-loads, using Rhesus monkey Miss Sam as a test subject.

May 9, 1960: Beach Abort Test. McDonnell's first production capsule and its escape rocket system were fired in an off-the-pad abort escape rocket system (capsule 1).

July 29, 1960: Mercury-Atlas 1. This was the first Atlas-boosted flight, and was aimed at qualifying the capsule under maximum airloads and afterbody heating rate during reentry conditions. The capsule contained no escape systems and no test subject. Shot was unsuccessful because of booster system malfunction (capsule 4).

November 8, 1960: Little Joe 5. This was another in the Little Joe series from Wallops Station. Purpose of the shot was to check the production capsule in an abort simulating the most severe Little Joe booster and the shot was unsuccessful (capsule 3).

<u>November 21, 1960</u>: Mercury-Redstone 1. This was the first unmanned Redstone-boosted flight, but premature engine cutoff activated the emergency escape system when the booster was only about one inch off the pad. The booster settled back on the pad and was damaged slightly. The capsule was recovered for re-use (capsule 2).

<u>December 19, 1960</u>: Mercury-Redstone 1A. This shot was a repeat of the November 21 attempt and was completely successful. Capsule reached a peak altitude of 135 statute miles, covered a horizontal distance of 236 statute miles and was recovered successfully (capsule 2).

<u>January 31, 1961</u>: Mercury-Redstone 2. This was the Mercury-Redstone shot which carried Ham, the 37-lb. chimpanzee. The capsule reached 155 statute miles altitude, landed 420 statute miles downrange, and was recovered. During the landing phase, the parachuting capsule was drifting as it struck the water. Impact of the angled blow slammed the suspended heat shield against a bundle of potted wires, which drove a bolt through the pressure bulkhead, causing the capsule to leak. Ham was rescued before the capsule had taken on too much water (capsule 5).

<u>February 21, 1961</u>: Mercury-Atlas 2. This Atlas-boosted capsule shot was to check maximum heating and its effect during the worst re-entry design conditions. Peak altitude was 108 statute miles; re-entry angle was higher than planned and the heating was correspondingly worse than anticipated. It landed 1425 statute miles downrange. Maximum speed was about 13,000 mph. Shot was successful (capsule 6).

<u>March 18, 1961</u>: Little Joe 5A. This was a repeat of the unsuccessful Little Joe 5; it was fired at Wallops Station and was only marginally successful (capsule 14).

<u>April 25, 1961</u>: Mercury-Atlas 3. This was an Atlas-boosted shot attempting to orbit the capsule with a "mechanical astronaut" aboard. But 40 sec. after launching, the booster was destroyed by radio command given by the range safety officer. The capsule was recovered and will be fired again (capsule 8).

<u>April 28, 1961:</u> Little Joe 5B. This was the third attempt to check the escape system under worst conditions, using a Little Joe booster fired from Wallops Station. Capsule reached 40,000 ft., and this time the shot was a complete success (capsule 14).

<u>May 5, 1961</u>: Mercury-Redstone 3. This Redstone-boosted shot carried Astronaut Alan B. Shepard, Jr. on a ballistic flight path reaching a peak altitude of 115 statute mi. and a downrange distance of 302 statute mi. Flight was successful (capsule 7).

# MR-4 RECOVERY OPERATIONS

CAPE CANAVERAL, FLA. - Ships, planes, helicopters and ground vehicles will be deployed in a number of areas to pick up the MR-4 spacecraft and pilot. These areas include Cape Canaveral, to cover the possibility of an abort while the vehicle is either on or just off the pad; near Cape Canaveral, for an abort during the early stages of flight; and the entire flight path from Cape Canaveral to beyond the predicted landing point in case of a late abort.

The Task Force assigned to recover the astronaut and spacecraft will be under the command of Rear Admiral J. L. Chew. The forces will be made up of units from the Destroyer Force, Naval Air Force, Fleet Marine Force, Service Force, Mine Force, USAF Air Rescue Service, and the Air Force Missile Test Center. Many of the units have taken part in earlier recovery exercises. Past experience and close coordination with NASA in the development of procedures and techniques for safe but expeditious recovery have been developed over the past two years.

Admiral Chew, Commander Destroyer Flotilla FOUR and Commander Project Mercury Recovery Force, will exercise command of the Recovery Force from the Recovery Control Room located in the National Aeronautics and Space Administration Mercury Control Center at Cape Canaveral, Florida. The Task Force is comprised of several Task Groups, each under an individual commander.

A Task Group dispersed along the track and in the predicted landing area will be under the command of Rear Admiral J. E. Clark, Commander Carrier Division 16 who will fly his flag in the aircraft carrier USS Randolph (CVS 15). The units of this group are:

USS Randolph (CVS 15) commanded by Capt. H. E. Cook, Jr.
USS Waller (DD466) commanded by Cdr. J. L. Rothermel
USS Kony (DDE 508) commanded by Cdr. F. C. Dunham, Jr.
USS Conway (DDE 507) commanded by Cdr. R. N. Keller
USS Strom (DD 780) commanded by Cdr. W. D. Millar
USS Lowry (DD 770) commanded by Cdr. J. P. Carpenter

Air support for this group will be provided by Patrol Squadron 5 P2V's commanded by Cdr. R. H. Casey, Jr., USN, and supplemented with USAF Air Rescue Service Aircraft. Carrier and shore-based helicopters will be provided from the veteran recovery unit, Marine Air Group 26, commanded by Col. P. T. Johnson, USMC.

A group positioned off shore consists of two minecraft and a rescue salvage vessel under the command of LCDR J. G. Everett. Another group located at Cape Canaveral consisting of numerous land vehicles and small craft from the Air Force Missile Test Center will be under the command of Lt. Col. Harry E. Cannon, USAF, of the Air Force Missile Test Center.